

USPTO Serial Number: 10/828,773
Fatemizadeh et al.
Reply to Office Action dated July 1, 2005

Amendment to the Claims:

1-6. (Cancelled)

7. (Currently amended) ~~The semiconductor device of claim 6,~~
~~further including~~ A semiconductor device having a gate region,
comprising:

an epitaxial region having a first conductivity type;

a first region disposed within the epitaxial region and
under the gate region, wherein the first region has a first
doping concentration of a second conductivity type opposite the
first conductivity type;

a second region disposed under the first region, wherein the
second region has a second doping concentration of the second
conductivity type which is less than the first doping
concentration; and

a trench formed in the epitaxial region for disposing the
gate region within the trench.

8. (Currently amended) The semiconductor device of claim ~~6~~ 7,
further including:

a drain region disposed below the epitaxial region; and

a source region disposed over a first portion of the
epitaxial region.

9. (Currently amended) The semiconductor device of claim ~~6~~ 7,
wherein the first conductivity type is N-type semiconductor
material.

10. (Currently amended) The semiconductor device of claim ~~6~~ 7,

USPTO Serial Number: 10/828,773
Fatemizadeh et al.
Reply to Office Action dated July 1, 2005

wherein the first region is made with P+ semiconductor material and the second region is made with P- semiconductor material.

11. (Currently amended) The semiconductor device of claim ~~6~~ 7, wherein the semiconductor device is a junction field effect transistor.

12. (Cancelled)

13. (Currently amended) The semiconductor device of claim ~~12~~ 14, further including a third region disposed adjacent to a second portion of the first region, wherein the third region has a doping concentration of the second conductivity type which is less than the first doping concentration.

14. (Currently amended) ~~The semiconductor device of claim 12, further including~~ A semiconductor device having a gate region, comprising:

an epitaxial region having a first conductivity type;
a first region disposed within the epitaxial region and under the gate region, wherein the first region has a first doping concentration of a second conductivity type opposite the first conductivity type;

a second region disposed adjacent to a first portion of the first region, wherein the second region has a doping concentration of the second conductivity type which is less than the first doping concentration; and

a trench formed in the epitaxial region for disposing the gate region within the trench.

USPTO Serial Number: 10/828,773

Fatemizadeh et al.

Reply to Office Action dated July 1, 2005

15. (Currently amended) The semiconductor device of claim ~~12~~
14, further including:

a drain region disposed below the epitaxial region; and
including a source region disposed over a first portion of
the epitaxial region.

16. (Currently amended) The semiconductor device of claim ~~12~~
14, wherein the first conductivity type is N-type semiconductor
material.

17. (Currently amended) The semiconductor device of claim ~~12~~
14, wherein the first region is made with P+ semiconductor
material and the second region is made with P- semiconductor
material.

19. (Currently amended) The semiconductor device of claim ~~12~~
14, wherein the semiconductor device is a junction field effect
transistor.

20. (Original) A semiconductor device, comprising:
a first gate region;
an epitaxial region having a first conductivity type; and
a first region disposed within the epitaxial region, under
the first gate region and extending at least half way through the
epitaxial region, wherein the first region has a second
conductivity type opposite the first conductivity type.

21. (Original) The semiconductor device of claim 20, further
including:

a second gate region; and

USPTO Serial Number: 10/828,773
Fatemizadeh et al.
Reply to Office Action dated July 1, 2005

a second region disposed within the epitaxial region, under the second gate region and extending at least half way through the epitaxial region, wherein the second region has the second conductivity type.

22. (Original) The semiconductor device of claim 21, further including a third region disposed between the first and second regions and having the first conductivity type.

23. (Original) The semiconductor device of claim 20, further including a trench formed in the epitaxial region for disposing the first gate region within the trench.

24. (Original) The semiconductor device of claim 20, further including:

a drain region disposed below the epitaxial region; and
a source region disposed over a first portion of the epitaxial region.

25. (Original) The semiconductor device of claim 20, wherein the first conductivity type is N-type semiconductor material.

26. (Original) The semiconductor device of claim 20, wherein the first region is made with P+ semiconductor material.

27. (Original) The semiconductor device of claim 20, wherein the semiconductor device is a junction field effect transistor.

28. (Original) A transistor having a gate region, drain region, and source region, comprising:

USPTO Serial Number: 10/828,773

Fatemizadeh et al.

Reply to Office Action dated July 1, 2005

an epitaxial region having a first conductivity type; and
a semiconductor material disposed within the epitaxial region, under the gate region and extending into the epitaxial region of sufficient depth to reduce drain to source resistance of the transistor, wherein the semiconductor material has a conductivity type which is opposite the first conductivity type.

29. (Original) The transistor of claim 28, wherein the semiconductor material includes:

a first region disposed within the epitaxial region, under a first portion of the gate region and extending at least half way through the epitaxial region; and

a second region disposed within the epitaxial region, under a second portion of the gate region and extending at least half way through the epitaxial region.

30. (Original) The transistor of claim 29, further including a third region disposed between the first and second region and having the first conductivity type.

31. (Original) The transistor of claim 28, wherein the semiconductor material includes:

a first region disposed within the epitaxial region and under the gate region, wherein the first region has a first doping concentration of a second conductivity type opposite the first conductivity type; and

a second region disposed under the first region, wherein the second region has a doping concentration of the second conductivity type which is less than the first doping concentration.

USPTO Serial Number: 10/828,773

Fatemizadeh et al.

Reply to Office Action dated July 1, 2005

32. (Original) The semiconductor device of claim 28, wherein the semiconductor device is a junction field effect transistor.